ARM Climate Research Facility

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Renewed Raman Lidar Generates Improved Data

The summer 2004 upgrades to the SGP Raman lidar (see June 2004 issue of *Southern Great Plains Newsletter*) have proven successful. The ten-month upgrade effort, completed in September, involved a major tune-up to restore and improve the lidar's data-gathering capabilities. The ground-based Raman lidar makes remote measurements of atmospheric properties such as water vapor mixing ratio (the ratio of water vapor to air), aerosol scattering ratio, and backscatter depolarization ratio. The instrument also generates various calculated cloud- and aerosol-related quantities.

After the upgrades, the lidar's data quality improved almost instantly. Dramatic decreases in random errors for water vapor mixing ratio and aerosol scattering measurements now indicate increased sensitivity. Figure 1 shows that the regions where these errors are only about 1% (indicated in black) have increased significantly. The instrument upgrades improved data quality enough to extend data collection to higher altitudes during both daytime and nighttime. (During daytime, ultraviolet radiation from the sun causes water vapor errors to increase above 4 km.)

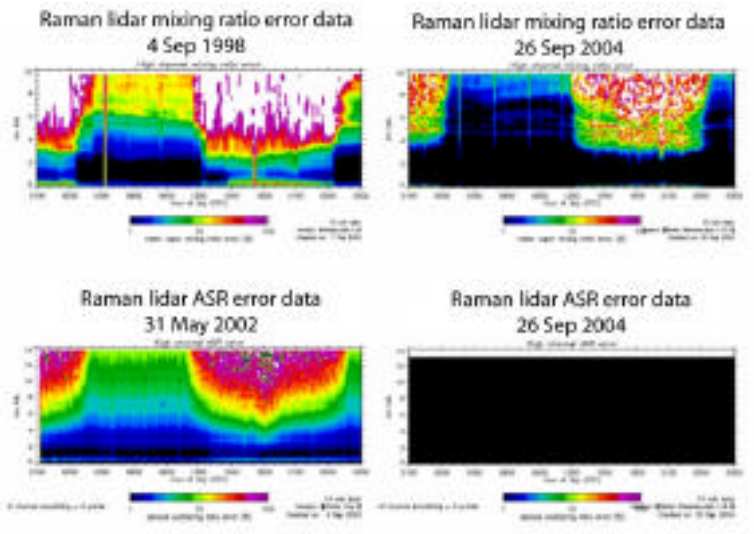

Figure 1. Errors in water vapor mixing ratio (top) and aerosol scattering ratio or ASR (bottom) before (left) and after (right) the upgrades to the Raman lidar at the SGP central facility near Lamont, Oklahoma (ARM graphic).

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New Radiometer Deployed at Central Facility

A new two-channel narrow-field-of-view (NFOV) radiometer was installed at the SGP central facility on September 15. The original single-channel instrument was also reinstalled after repair to correct lightning damage. The NFOV radiometers measure the amount of solar radiation reaching the surface in wavelength bands at 673 and 870 nanometers. This type of radiometer looks directly upward at a very small part of the sky to measure what is called downwelling zenith radiance. The measurements are used to study the internal structures of clouds.

Figure 2. The cylindrical single-channel NFOV radiometer (left) and the new two-channel NFOV radiometer (right) were recently installed together at the SGP central facility (ARM photo).

Climate Capsule

"Climate Capsule" is a new monthly feature introducing climate and weather definitions.

water vapor feedback

: a process in which an increase in the amount of water vapor increases the atmosphere's absorption of longwave (thermal) radiation or heat, thereby contributing to a warming of the atmosphere. Warming, in turn, may result in increased evaporation and an increase in the initial water vapor anomaly. This positive feedback, along with carbon dioxide, is responsible for the greenhouse effect and operates virtually continuously in the atmosphere. However, water in the atmosphere does not remain entirely in the vapor state; some vapor condenses to form clouds and eventually returns to the surface as precipitation. Clouds reduce the thermal radiation (heat) escaping to space — a positive feedback — but also reflect solar radiation (sunlight) back into space — a negative feedback. Whether the net effect of the interacting processes of evaporation and cloud formation is to warm or cool Earth depends on many factors. This complexity makes the interacting processes difficult to model accurately. The mission of the ARM Program is to improve models of cloud processes and radiation transfer through clouds so that the models can predict Earth's future climate accurately.

Okmulgee Turkey Vultures Thwarted . . . Finally!

After years of trying to keep messy turkey vultures off the instruments on the Okmulgee tower, ARM engineers have finally found an effective solution. Final modifications to the motorized rotating bird deterrent on the tower are preventing the birds from roosting on the instruments and soiling and damaging them to the point of making data collection impossible. The rotating deterrent moves two steel rods in horizontal circles above the instruments on the tower. The constantly moving rods either frighten the birds or physically prod them and keep them away. In another modification, larger, more durable spikes were installed on the booms supporting the instruments to prevent the vultures from landing on the systems.

Figure 3. The rotating bird deterrent (left in photo) is keeping turkey vultures from soiling the instruments mounted on the Okmulgee tower. Evidence of the birds' past visits adorns the enclosure (right) below the radiometer (ARM photo).